

WE CLAIM:

1. A curable electrodepositable coating composition comprising a resinous phase dispersed in an aqueous medium, said resinous phase comprising:

- 5 (a) one or more ungelled, active hydrogen-containing cationic sulfonium salt group-containing resins which are electrodepositable on a cathode, and
(b) one or more curing agents comprising cationic groups or groups which are capable of forming cationic groups.

10 2. The composition of claim 1, wherein the active hydrogen-containing, cationic sulfonium salt group-containing resin (a) is selected from a polyepoxide polymer, an acrylic polymer, a polyurethane polymer, a polyester polymer, copolymers thereof and combinations thereof.

15 3. The composition of claim 1, wherein the resin (a) is present in the electrodepositable coating composition in an amount ranging from 10 to 95 percent, based on total weight of resin solids present in the electrodepositable coating composition.

20 4. The composition of claim 1, wherein the resin (a) comprises a polyepoxide polymer.

5. The composition of claim 1, wherein the resin (a) comprises an acrylic polymer.

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6. The composition of claim 1, wherein the resin (a) comprises a polyurethane polymer.

30 7. The composition of claim 1, wherein the resin (a) comprises a polyester polymer.

8. The composition of claim 1, wherein the curing agent (b) is present in the electrodepositable coating composition in an amount ranging from 5 to 90 percent, based on total weight of resin solids present in the electrodepositable coating composition.

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9. The composition of claim 1, wherein the curing agent (b) comprises an at least partially blocked polyisocyanate.

10. The composition of claim 9, wherein the curing agent (b) comprises an at least partially blocked aliphatic, aromatic, or araliphatic polyisocyanate.

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11. The composition of claim 10, wherein the curing agent (b) comprises an at least partially blocked aromatic polyisocyanate selected from the group consisting of 2,4-toluene diisocyanate, 2,6-toluene diisocyanate, methylene diphenyl diisocyanate, oligomeric methylene diphenyl diisocyanate, and mixtures thereof.

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12. The composition of claim 10, wherein the curing agent (b) comprises an at least partially blocked aliphatic polyisocyanate selected from the group consisting of 1,6-hexamethylene diisocyanate, isophorone diisocyanate, bis-(isocyanatocyclohexyl)methane, polymeric 1,6-hexamethylene diisocyanate, trimerized isophorone diisocyanate, norbornane diisocyanate, and mixtures thereof.

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13. The composition of claim 9, wherein the curing agent (b) comprises an at least partially blocked polyisocyanate comprising one or more cationic amine salt groups or groups capable of forming cationic amine salt groups.

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14. The composition of claim 13, wherein the curing agent (b) comprises an at least partially blocked polyisocyanate comprising one or more pendant basic amine groups.

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15. The composition of claim 14, wherein the pendant amine groups are capable of being protonated at a pH greater than or equal to 4.

16. The composition of claim 15, wherein the pendant amine groups are capable of being protonated at a pH greater than or equal to 5.

5 17. The composition of claim 13, wherein the amine salt groups are derived from one or more primary amine groups.

18. The composition of claim 9, wherein the curing agent (b) comprises a blocked polyisocyanate essentially free of tertiary amine groups.

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19. The composition of claim 1, wherein the curing agent (b) is at least partially blocked with at least one blocking agent selected from an alkyl alcohol, a 1,2-alkane diol, a 1,3-alkane diol, a benzylic alcohol, an allylic alcohol, an oxime, a glycol ether, caprolactam, a dialkylamine and mixtures thereof.

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20. The composition of claim 1, wherein the curing agent (b) comprises cationic salt groups derived from at least one compound selected from ethanolamine, propanolamine, 4-amino-1-butanol and 5-amino-1-pentanol, diglycolamine, 2-amino-2-methyl-1-propanol, 2-(2-aminoethylamino)ethanol, 2-(3-aminopropylamino)ethanol, aminoethylpiperazine, N-propylethylenediamine, N-methylpropanediamine, diethylenetriamine, 1,3-diamino-2-hydroxypropane, triethylene tetramine and higher homologs, and the reaction product of a primary amine in the form of a ketimine which also contain at least one active hydrogen group with an epoxide such as ethylene oxide or propylene oxide.

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21. The composition of claim 20, wherein the curing agent (b) comprises cationic salt groups derived from at least one compound selected from diglycolamine, ethanolamine, diethylenetriamine, 2-(2-aminoethylamino)ethanol, and 2-amino-2-methyl-1-propanol.

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22. The composition of claim 1, wherein said electrodepositable coating composition is in the form of an electrodeposition bath having conductivity 1000 to 3000 microsiemens/cm at 20 percent solids.

5 23. A process for coating an electroconductive substrate comprising the following steps:

(a) electrophoretically depositing on the substrate a curable electrodepositable coating composition to form an electrodeposited coating over at least a portion of the substrate, the electrodepositable coating composition comprising
10 a resinous phase dispersed in an aqueous medium, said resinous phase comprising:

(i) one or more ungelled, active hydrogen-containing cationic sulfonium salt group-containing resins which are electrodepositable on a cathode, and

(ii) one or more curing agents comprising cationic amine salt groups or groups which are capable of forming cationic amine salt groups;
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(b) heating the coated substrate to a temperature and for a time sufficient to cure the electrodeposited coating on the substrate;

(c) applying directly to the cured electrodeposited coating one or more pigment-containing coating compositions and/or one or more pigment-free coating compositions to form a top coat over at least a portion of the cured electrodeposited coating; and
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(d) heating the coated substrate of step (c) to a temperature and for a time sufficient to cure the top coat.

25 24. The process of claim 23, wherein the cured top coat has from 0.1 to 50 percent light transmission measured at 400 nanometers.

25. The process of claim 23, wherein the active hydrogen-containing, cationic sulfonium salt-containing resin (i) is selected from a polyepoxide polymer, an acrylic polymer, a polyurethane polymer, a polyester polymer, copolymers thereof and combinations thereof.
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26. The process of claim 23, wherein the resin (i) comprises a polyepoxide polymer.

27. The process of claim 23, wherein the resin (i) comprises an acrylic polymer.

28. The process of claim 23, wherein the curing agent (ii) comprises an at least partially blocked polyisocyanate.

29. The process of claim 28, wherein the curing agent (ii) comprises an at least partially blocked aliphatic polyisocyanate.

30. The process of claim 29, wherein the curing agent (ii) comprises an at least partially blocked aliphatic polyisocyanate selected from the group consisting of 1,6-hexamethylene diisocyanate, isophorone diisocyanate, bis-(isocyanatocyclohexyl)methane, polymeric 1,6-hexamethylene diisocyanate, trimerized isophorone diisocyanate, norbornane diisocyanate, and mixtures thereof.

31. The process of claim 23, wherein the curing agent (ii) comprises an at least partially blocked polyisocyanate comprising one or more pendant basic amine groups.

32. The process of claim 31, wherein the pendant amine groups are capable of being protonated at a pH greater than or equal to 4.

33. The process of claim 32, wherein the pendant amine groups are capable of being protonated at a pH greater than or equal to 5.

34. The process of claim 23, wherein the amine salt groups are derived from one or more primary amine groups.

35. The process of claim 28, wherein the curing agent (ii) comprises a blocked polyisocyanate essentially free of tertiary amine groups.

36. The process of claim 23, wherein the nitrogen derived from the amine salt groups of curing agent (ii) is present in the cured electrodeposited film of step (b).

37. The process of claim 36, wherein the nitrogen derived from the amine salt groups of curing agent (ii) is substantially consumed in step (b) to form urea groups.

38. The process of claim 23, wherein the curing agent (ii) is at least partially blocked with at least one blocking agent selected from the group consisting of an alkyl alcohol, a 1,2-alkane diol, a 1,3-alkane diol, a benzylic alcohol, an allylic alcohol, an oxime, a glycol ether, caprolactam, a dialkylamine, and mixtures thereof.

39. The process of claim 23, wherein the curing agent (ii) comprises cationic amine salt groups derived from at least one compound selected from ethanolamine, propanolamine, 4-amino-1-butanol and 5-amino-1-pentanol, diglycolamine, 2-amino-2-methyl-1-propanol, 2-(2-aminoethylamino)ethanol, 2-(3-aminopropylamino)ethanol, aminoethylpiperazine, N-propylethylenediamine, N-methylpropanediamine, diethylenetriamine, 1,3-diamino-2-hydroxypropane, triethylene tetramine and higher homologs, and the reaction product of a primary amine in the form of a ketimine which also contain at least one active hydrogen group with an epoxide such as ethylene oxide or propylene oxide.

40. The process of claim 39, wherein the curing agent (ii) comprises cationic salt groups derived from diglycolamine, ethanolamine, diethylenetriamine, 2-(2-aminoethylamino)ethanol, and 2-amino-2-methyl-1-propanol.

41. The process of claim 23, wherein said electrodepositable coating composition is in the form of an electrodeposition bath having conductivity 1000 to 3000 microsiemens/cm at 20 percent solids.

42. The process of claim 23, wherein the coated substrate of step (a) is heated to a temperature ranging from 275° to 400°F (135° to 204.4°C).

43. The process of claim 23, wherein the electrodepositable coating composition is free of lead compounds.

44. The process of claim 23, wherein the coated substrate of step (a) is heated in an atmosphere having 5 parts per million or less of NO_x to a temperature and for a time sufficient to cure the electrodeposited coating on the substrate.

45. A process for forming a photodegradation-resistant multi-layer coating on an electroconductive substrate comprising the following steps:

(a) electrophoretically depositing on the substrate a curable electrodepositable coating composition to form an electrodeposited coating over at least a portion of the substrate, the electrodepositable coating composition comprising a resinous phase dispersed in an aqueous medium, said resinous phase comprising:

(i) one or more ungelled, active hydrogen-containing cationic sulfonium salt group-containing resins which are electrodepositable on a cathode, and

(ii) one or more curing agents comprising cationic amine salt groups or groups which are capable of forming cationic amine salt groups;

(b) heating the coated substrate in an atmosphere having 5 parts per million or less of NO_x at a temperature and for a time sufficient to cure the electrodeposited coating on the substrate;

(c) applying directly to the cured electrodeposited coating one or more pigment-containing coating compositions and/or one or more pigment-free coating compositions to form a top coat over at least a portion of the cured electrodeposited coating; and

(d) heating the coated substrate of step (c) to a temperature and for a time sufficient to cure the top coat.

46. The process of claim 45, wherein the cured top coat has from 0.1 to 50 percent light transmission measured at 400 nanometers.

47. The process of claim 45, wherein the active hydrogen-containing, cationic sulfonium salt-containing resin (i) is selected from a polyepoxide polymer, an acrylic polymer, a polyurethane polymer, a polyester polymer, copolymers thereof and combinations thereof.

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48. The process of claim 45, wherein the resin (i) comprises a polyepoxide polymer.

49. The process of claim 45, wherein the resin (i) comprises an acrylic polymer.

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50. The process of claim 45, wherein the curing agent (ii) comprises an at least partially blocked polyisocyanate.

51. The process of claim 50, wherein the curing agent (ii) comprises an at least partially blocked aliphatic polyisocyanate.

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52. The process of claim 51, wherein the curing agent (ii) comprises an at least partially blocked aliphatic polyisocyanate selected from the group consisting of 1,6-hexamethylene diisocyanate, isophorone diisocyanate, bis-(isocyanatocyclohexyl)methane, polymeric 1,6-hexamethylene diisocyanate, trimerized isophorone diisocyanate, norbornane diisocyanate, and mixtures thereof.

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53. The process of claim 45, wherein the curing agent (ii) comprises an at least partially blocked polyisocyanate comprising one or more pendant basic amine groups.

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54. The process of claim 53, wherein the pendant amine groups are capable of being protonated at a pH greater than or equal to 4.

55. The process of claim 54, wherein the pendant amine groups are capable of being protonated at a pH greater than or equal to 5.

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56. The process of claim 45, wherein the amine salt groups are derived from one or more primary amine groups.

57. The process of claim 50, wherein the curing agent (ii) comprises a blocked
5 polyisocyanate essentially free of tertiary amine groups.

58. The process of claim 45, wherein the nitrogen derived from the amine salt groups of curing agent (ii) is present in the cured electrodeposited film of step (b).

10 59. The process of claim 58, wherein the nitrogen derived from the amine salt groups of curing agent (ii) is substantially consumed in step (b) to form urea groups.

60. The process of claim 45, wherein the curing agent (ii) is at least partially blocked with at least one blocking agent selected from the group consisting of an
15 alkyl alcohol, a 1,2-alkane diol, a 1,3-alkane diol, a benzylic alcohol, an allylic alcohol, an oxime, a glycol ether, caprolactam, a dialkylamine, and mixtures thereof.

61. The process of claim 45, wherein the curing agent (ii) comprises cationic amine salt groups derived from at least one compound selected from ethanolamine, propanolamine, 4-amino-1-butanol, 5-amino-1-pentanol, diglycolamine, 2-amino-2-
20 methyl-1-propanol, 2-(2-aminoethylamino)ethanol, 2-(3-aminopropylamino)ethanol, aminoethylpiperazine, N-propylethylenediamine, N-methylpropanediamine, diethylenetriamine, 1,3-diamino-2-hydroxypropane, triethylene tetramine and higher homologs, and the reaction product of a primary amine in the form of a ketimine
25 which also contain at least one active hydrogen group with an epoxide such as ethylene oxide or propylene oxide.

62. The process of claim 61, wherein the curing agent (ii) comprises cationic salt groups derived from diglycolamine, ethanolamine, diethylenetriamine, 2-(2-
30 aminoethylamino)ethanol, and 2-amino-2-methyl-1-propanol.

63. The process of claim 45, wherein said electrodepositable coating composition is in the form of an electrodeposition bath having conductivity 1000 to 3000 microsiemens/cm at 20 percent solids.

5 64. The process of claim 45, wherein the coated substrate of step (a) is heated to a temperature ranging from 275° to 400°F (135° to 204.4°C).

65. The process of claim 45, wherein the electrodepositable coating composition is free of lead compounds.

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66. A process for forming a photodegradation-resistant multi-layer coating on an electroconductive substrate comprising the following steps:

(a) electrophoretically depositing on the substrate a curable electrodepositable coating composition to form an electrodeposited coating over at least a portion of the substrate, the substrate serving as a cathode in an electrical circuit comprising the cathode and an anode, the cathode and the anode being immersed in the aqueous electrodepositable coating composition, wherein electric current is passed between the cathode and the anode to cause the coating to be electrodeposited over at least a portion of the substrate, the electrodepositable coating composition comprising a resinous phase dispersed in an aqueous medium, said resinous phase comprising:

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(i) one or more ungelled, active hydrogen-containing cationic sulfonium salt group-containing resins which are depositable on a cathode, and

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(ii) one or more curing agents comprising cationic amine salt groups or groups which are capable of forming cationic amine salt groups;

(b) heating the coated at a temperature and for a time sufficient to cure the electrodeposited coating on the substrate;

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(c) applying directly to the cured electrodeposited coating one or more pigment-containing coating compositions and/or one or more pigment-free coating compositions to form a top coat over at least a portion of the cured electrodeposited coating; and

(d) heating the coated substrate of step (c) to a temperature and for a time sufficient to cure the top coat, wherein the improvement comprises the inclusion in the circuit of a non-ferrous anode.

5 67. The process of claim 66, wherein the aqueous electrodepositable coating composition is in the form of an electrodeposition bath comprising less than 10 parts per million soluble iron.

68. The process of claim 66, wherein the coated substrate of step (a) is heated in
10 an atmosphere having 5 parts per million or less of NO_x.

69. The process of claim 66, wherein the cured electrodeposited coating of step (b) comprises less than 10 parts per million soluble iron.

15 70. The process of claim 66, wherein the curable electrodepositable coating composition further comprises a material selected from at least one of a hindered amine light stabilizer, an antioxidant, an ultraviolet light absorber, and mixtures thereof.

20 71. A curable electrodepositable coating composition comprising a resinous phase dispersed in an aqueous medium, said resinous phase comprising:

(a) one or more ungelled, active hydrogen-containing cationic sulfonium salt group-containing resins which are depositable on a cathode, said resins selected from at least one of an acrylic polymer, a polyepoxide polymer, and mixtures thereof,
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(b) one or more aliphatic polyisocyanate curing agents comprising amine salt groups derived from one or more primary amine groups selected from diglycolamine, ethanolamine, diethylenetriamine, 2-(2-aminoethylamino)ethanol, and 2-amino-2-methyl-1-propanol.
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72. A process for forming a photodegradation-resistant multi-layer coating on an electroconductive substrate comprising the following steps:

(a) electrophoretically depositing on the substrate a curable electrodepositable coating composition to form an electrodeposited coating over at least a portion of the substrate, the electrodepositable coating composition comprising a resinous phase dispersed in an aqueous medium, said resinous phase comprising:

- 5 (i) one or more ungelled, active hydrogen-containing cationic sulfonium salt group-containing resins which are depositable on a cathode, said resins selected from at least one of an acrylic polymer, a polyepoxide polymer, and mixtures thereof; and
- 10 (ii) one or more aliphatic polyisocyanate curing agents comprising amine salt groups derived from one or more primary amine groups selected from diglycolamine, ethanolamine, diethylenetriamine, 2-(2-aminoethylamino)ethanol, and 2-amino-2-methyl-1-propanol;

(b) heating the coated substrate to a temperature ranging from 275° to 400°F (135° to 204.4°C) for a time sufficient to cure the electrodeposited coating on the substrate;

(c) applying directly to the cured electrodeposited coating one or more pigment-containing coating compositions and/or one or more pigment-free coating compositions to form a top coat over at least a portion of the cured electrodeposited coating;

20 (d) heating the coated substrate of step (c) to a temperature and for a time sufficient to cure the top coat.

73. A photodegradation-resistant multi-layer composite coating comprising: a cured primer coating layer over at least a portion of an electroconductive substrate, and a cured top coat layer over at least a portion of the cured primer coating layer, the primer coating layer being formed from a curable electrodepositable coating composition comprising a resinous phase dispersed in an aqueous medium, said resinous phase comprising:

- 25 (a) one or more ungelled, active hydrogen-containing cationic sulfonium salt group-containing resins which are depositable on a cathode, and
- 30 (b) one or more curing agents comprising cationic amine salt groups or groups which are capable of forming cationic amine salt groups,

the top coat layer being formed from one or more pigment-containing coating compositions and/or one or more pigment-free coating compositions, characterized in that the multi-layer composite coating exhibits substantially no interlayer delamination between the cured primer coating layer and the cured top coat layer upon concentrated solar spectral irradiance exposure equivalent to two years outdoor weathering when the top coat layer has at least 80 percent light transmission as measured at 400 nanometers.

74. The multi-layer composite coating of claim 73, wherein the cured top coat has from 0.1 to 50 percent light transmission measured at 400 nanometers.

75. The multi-layer composite coating of claim 73, wherein the active hydrogen-containing, cationic sulfonium salt-containing resin (a) is selected from a polyepoxide polymer, an acrylic polymer, a polyurethane polymer, a polyester polymer, copolymers thereof and combinations thereof.

76. The multi-layer composite coating of claim 73, wherein the resin (a) comprises a polyepoxide polymer.

77. The multi-layer composite coating of claim 73, wherein the resin (a) comprises an acrylic polymer.

78. The multi-layer composite coating of claim 73, wherein the curing agent (b) comprises an at least partially blocked polyisocyanate.

79. The multi-layer composite coating of claim 73, wherein the curing agent (b) comprises an at least partially blocked aliphatic polyisocyanate.

80. The multi-layer composite coating of claim 79, wherein the curing agent (b) comprises an at least partially blocked aliphatic polyisocyanate selected from the group consisting of 1,6-hexamethylene diisocyanate, isophorone diisocyanate, bis-

(isocyanatocyclohexyl)methane, polymeric 1,6-hexamethylene diisocyanate, trimerized isophorone diisocyanate, norbornane diisocyanate, and mixtures thereof.

5 81. The multi-layer composite coating of claim 73, wherein the curing agent (b) comprises an at least partially blocked polyisocyanate comprising one or more pendant basic amine groups.

10 82. The multi-layer composite coating of claim 81, wherein the pendant amine groups are capable of being protonated at a pH greater than or equal to 4.

83. The multi-layer composite coating of claim 82, wherein the pendant amine groups are capable of being protonated at a pH greater than or equal to 5.

15 84. The multi-layer composite coating of claim 73, wherein the amine salt groups are derived from one or more primary amine groups.

85. The multi-layer composite coating of claim 78, wherein the curing agent (b) comprises a blocked polyisocyanate essentially free of tertiary amine groups.

20 86. The multi-layer composite coating of claim 73, wherein the nitrogen derived from the amine salt groups of curing agent (b) is present in the cured primer coating layer.

25 87. The multi-layer composite coating of claim 86, wherein the nitrogen derived from the amine salt groups of curing agent (b) is substantially present in the form of urea groups in the cured primer coating.

30 88. The multi-layer composite coating of claim 73, wherein the curing agent (b) is at least partially blocked with at least one blocking agent selected from the group consisting of an alkyl alcohol, a 1,2-alkane diol, a 1,3-alkane diol, a benzylic alcohol, an allylic alcohol, an oxime, a glycol ether, caprolactam, a dialkylamine, and mixtures thereof.

89. The multi-layer composite coating of claim 73, wherein the curing agent (b) comprises cationic amine salt groups derived from at least one compound selected from ethanolamine, propanolamine, 4-amino-1-butanol, 5-amino-1-pentanol,
5 diglycolamine, 2-amino-2-methyl-1-propanol, 2-(2-aminoethylamino)ethanol, 2-(3-aminopropylamino)ethanol, aminoethylpiperazine, N-propylethylenediamine, N-methylpropanediamine, diethylenetriamine, 1,3-diamino-2-hydroxypropane, triethylene tetramine and higher homologs, and the reaction product of a primary amine in the form of a ketimine which also contain at least one active hydrogen group with an
10 epoxide such as ethylene oxide or propylene oxide.

90. The multi-layer composite coating of claim 89, wherein the curing agent (b) comprises cationic salt groups derived from diglycolamine, ethanolamine, diethylenetriamine, 2-(2-aminoethylamino)ethanol, and 2-amino-2-methyl-1-
15 propanol.

91. The multi-layer composite coating of claim 73, wherein said electrodepositable coating composition is in the form of an electrodeposition bath having conductivity 1000 to 3000 microsiemens/cm at 20 percent solids.
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92. The multi-layer composite coating of claim 73, wherein the coated substrate of step (a) is heated to a temperature ranging from 275° to 400°F (135° to 204.4°C).

93. The multi-layer composite coating of claim 73, wherein the electrodepositable
25 coating composition is free of lead compounds.

94. A photodegradation-resistant multi-layer composite coating comprising: a cured primer coating layer over at least a portion of an electroconductive substrate, and a cured top coat layer over at least a portion of the cured primer coating layer, the
30 primer coating layer being formed from a curable electrodepositable coating composition comprising a resinous phase dispersed in an aqueous medium, said resinous phase comprising:

(a) one or more ungelled, active hydrogen-containing cationic sulfonium salt group-containing resins which are depositable on a cathode, said resins selected from at least one of an acrylic polymer, a polyepoxide polymer, and mixtures thereof, and

5 (b) one or more aliphatic polyisocyanate curing agents comprising amine salt groups derived from one or more primary amine groups selected from diglycolamine, ethanolamine, diethylenetriamine, 2-(2-aminoethylamino)ethanol, and 2-amino-2-methyl-1-propanol,

the top coat layer being formed from one or more pigment-containing coating
10 compositions and/or one or more pigment-free coating compositions, characterized in that the multi-layer composite coating exhibits substantially no interlayer delamination between the cured primer coating layer and the cured top coat layer upon concentrated solar spectral irradiance exposure equivalent to two years outdoor weathering when the top coat layer has at least 80 percent light transmission as
15 measured at 400 nanometers.

95. A process for coating an electroconductive substrate comprising the following steps:

(a) electrophoretically depositing on the substrate a curable
20 electrodepositable coating composition to form an electrodeposited coating over at least a portion of the substrate, the electrodepositable coating composition comprising a resinous phase dispersed in an aqueous medium, said resinous phase comprising:

(i) one or more ungelled, active hydrogen-containing cationic sulfonium salt group-containing resins which are electrodepositable on a
25 cathode, and

(ii) one or more curing agents comprising cationic amine salt groups or groups which are capable of forming cationic amine salt groups; and

(b) heating the coated substrate to a temperature and for a time sufficient to cure the electrodeposited coating on the substrate.

30 96. The process of claim 95, wherein the active hydrogen-containing, cationic sulfonium salt group-containing resin (i) is selected from a polyepoxide polymer, an

acrylic polymer, a polyurethane polymer, a polyester polymer, copolymers thereof and combinations thereof.

5 97. The process of claim 95, wherein the resin (i) is present in the electrodepositable coating composition in an amount ranging from 10 to 95 percent, based on total weight of resin solids present in the electrodepositable coating composition.

10 98. The process of claim 95, wherein the resin (i) comprises a polyepoxide polymer.

99. The process of claim 95, wherein the resin (i) comprises an acrylic polymer.

15 100. The process of claim 95, wherein the resin (i) comprises a polyurethane polymer.

101. The process of claim 95, wherein the resin (i) comprises a polyester polymer.

20 102. The process of claim 95, wherein the curing agent (ii) is present in the electrodepositable coating composition in an amount ranging from 5 to 90 percent, based on total weight of resin solids present in the electrodepositable coating composition.

25 103. The process of claim 95, wherein the curing agent (ii) comprises an at least partially blocked polyisocyanate.

104. The process of claim 103, wherein the curing agent (ii) comprises an at least partially blocked aliphatic, aromatic, or araliphatic polyisocyanate.

30 105. The process of claim 104, wherein the curing agent (ii) comprises an at least partially blocked aromatic polyisocyanate selected from the group consisting of 2,4-

toluene diisocyanate, 2,6-toluene diisocyanate, methylene diphenyl diisocyanate, oligomeric methylene diphenyl diisocyanate, and mixtures thereof.

106. The process of claim 104, wherein the curing agent (ii) comprises an at least partially blocked aliphatic polyisocyanate selected from the group consisting of 1,6-hexamethylene diisocyanate, isophorone diisocyanate, bis-(isocyanatocyclohexyl)methane, polymeric 1,6-hexamethylene diisocyanate, trimerized isophorone diisocyanate, norbornane diisocyanate, and mixtures thereof.

107. The process of claim 95, wherein the curing agent (ii) comprises an at least partially blocked polyisocyanate comprising one or more pendant basic amine groups.

108. The process of claim 107, wherein the pendant amine groups are capable of being protonated at a pH greater than or equal to 4.

109. The process of claim 108, wherein the pendant amine groups are capable of being protonated at a pH greater than or equal to 5.

110. The process of claim 95, wherein the amine salt groups are derived from one or more primary amine groups.

111. The process of claim 103, wherein the curing agent (ii) comprises a blocked polyisocyanate essentially free of tertiary amine groups.

112. The process of claim 95, wherein the nitrogen derived from the amine salt groups of curing agent (ii) is present in the cured electrodeposited film of step (b).

113. The process of claim 112, wherein the nitrogen derived from the amine salt groups of curing agent (ii) is substantially consumed in step (b) to form urea groups.

114. The process of claim 95, wherein the curing agent (ii) is at least partially blocked with at least one blocking agent selected from an alkyl alcohol, a 1,2-alkane

diol, a 1,3-alkane diol, a benzylic alcohol, an allylic alcohol, an oxime, a glycol ether, caprolactam, a dialkylamine and mixtures thereof.

115. The process of claim 95, wherein the curing agent (ii) comprises cationic salt groups derived from at least one compound selected from ethanolamine, propanolamine, 4-amino-1-butanol, 5-amino-1-pentanol, diglycolamine, 2-amino-2-methyl-1-propanol, 2-(2-aminoethylamino)ethanol, 2-(3-aminopropylamino)ethanol, aminoethylpiperazine, N-propylethylenediamine, N-methylpropanediamine, diethylenetriamine, 1,3-diamino-2-hydroxypropane, triethylene tetramine and higher homologs, and the reaction product of a primary amine in the form of a ketimine which also contain at least one active hydrogen group with an epoxide such as ethylene oxide or propylene oxide.

116. The process of claim 115, wherein the curing agent (ii) comprises cationic salt groups derived from at least one compound selected from diglycolamine, ethanolamine, diethylenetriamine, 2-(2-aminoethylamino)ethanol, and 2-amino-2-methyl-1-propanol.

117. The process of claim 95, wherein said electrodepositable coating composition is in the form of an electrodeposition bath having conductivity 1000 to 3000 microsiemens/cm at 20 percent solids.

118. The process of claim 95, wherein the coated substrate of step (i) is heated to a temperature ranging from 275° to 400°F (135° to 204.4°C).